Name: ______________________________ Date: ______________

Polynomial Operations SOLUTION (version 149)

1. Let polynomials $p(x)$ and $q(x)$ be defined below.

$$p(x) = -7x^5 + 8x^4 + 4x^3 - 9x^2 - 3$$

$$q(x) = -6x^5 - 3x^4 - x^2 + 8x + 7$$

Express the difference $p(x) - q(x)$ in standard form.

Get "unsimplified" forms. Then find $p(x) - q(x)$ with addition/subtraction.

$$\begin{aligned} p(x) &= (-7)x^5 + (8)x^4 + (4)x^3 + (-9)x^2 + (0)x^1 + (-3)x^0 \\ q(x) &= (-6)x^5 + (-3)x^4 + (0)x^3 + (-1)x^2 + (8)x^1 + (7)x^0 \\ p(x) - q(x) &= (-1)x^5 + (11)x^4 + (4)x^3 + (-8)x^2 + (-8)x^1 + (-10)x^0 \\ p(x) - q(x) &= -x^5 + 11x^4 + 4x^3 - 8x^2 - 8x - 10 \end{aligned}$$

2. Let polynomials $a(x)$ and $b(x)$ be defined below.

$$a(x) = -9x^2 + 3x + 2$$

$$b(x) = 7x + 4$$

Express the product $a(x) \cdot b(x)$ in standard form.

You can use a table for multiplication.

*	$-9x^2$	$3x$	2
$7x$	$-63x^3$	$21x^2$	$14x$
4	$-36x^2$	$12x$	8

$$a(x) \cdot b(x) = -63x^3 + 21x^2 - 36x^2 + 14x + 12x + 8$$

Combine like terms.

$$a(x) \cdot b(x) = -63x^3 - 15x^2 + 26x + 8$$

3. Express $(x + 1)^4$ in standard (expanded) form.

Remember the binomial theorem. It tells us to use Pascal's triangle.

$$x^4 + 4x^3 + 6x^2 + 4x + 1$$

Polynomial Operations SOLUTION (version 149)

4. Let polynomials $f(x)$ and $g(x)$ be defined below.

$$\begin{aligned} f(x) &= x^3 + 6x^2 - 12x + 27 \\ g(x) &= x + 8 \end{aligned}$$

The quotient of $\frac{f(x)}{g(x)}$ can be expressed as a polynomial, $h(x)$, and a remainder, R (a real number).

$$\frac{f(x)}{g(x)} = h(x) + \frac{R}{x+8}$$

By using synthetic division or long division, express $h(x)$ in standard form, and find the remainder R.

I prefer using synthetic division.

$$\begin{array}{r|rrrr} & 1 & 6 & -12 & 27 \\ -8 & & -8 & 16 & -32 \\ \hline & 1 & -2 & 4 & -5 \end{array}$$

So,

$$\frac{f(x)}{g(x)} = x^2 - 2x + 4 + \frac{-5}{x+8}$$

In other words, $h(x) = x^2 - 2x + 4$ and the remainder is $R = -5$.

5. Let polynomial $f(x)$ still be defined as $f(x) = x^3 + 6x^2 - 12x + 27$. Evaluate $f(-8)$.

You could do this the hard way.

$$\begin{aligned} f(-8) &= (1)\cdot(-8)^3 + (6)\cdot(-8)^2 + (-12)\cdot(-8) + (27) \\ &= (1)\cdot(-512) + (6)\cdot(64) + (-12)\cdot(-8) + (27) \\ &= (-512) + (384) + (96) + (27) \\ &= -5 \end{aligned}$$

Or, if you reference the polynomial remainder theorem, you can state that you know $f(-8)$ equals the remainder when $f(x)$ is divided by $x + 8$. Thus, $f(-8) = -5$.